

# **FCC/IC - TEST REPORT**

Report Number	: 68.910.18.0077.01 Date of Issue: October 30, 2018						
Model	: PZ-UA028						
Product Type	: AROMA DIFFUSER						
Applicant	: Puzhen Life Co., Ltd.						
Address	: Unit 1112-1116, 11/F, Delta House, 3 On Yiu Street, Shatin,						
	HONG KONG						
Manufacturer	: Puzhen Life Co., Ltd.						
Address	: Unit 1112-1116, 11/F, Delta House, 3 On Yiu Street, Shatin,						
	HONG KONG						
Test Result	E Positive  ☐ Negative						
Total pages including Appendices	: 52						

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# 2 Details about the Test Laboratory

# Details about the Test Laboratory

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052 P.R. China
Telephone: Fax:	86 755 8828 6998 86 755 828 5299
FCC Registration	514049
IC Registration No.:	10320A -1



# **3** Description of the Equipment Under Test

Product:	AROMA DIFFUSER
Model no.:	PZ-UA028
FCC ID:	2AQU4-PZUA028
IC:	24212-PZUA028
Options and accessories:	NIL
Rated input:	100-240VAC; 50/60Hz; 0.4A (for AC Adapter); 24VDC; 0.5A (for AROMA DIFFUSER)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type:	Integrated antenna
Antenna Gain:	3.7dBi
Description of the EUT:	The Equipment Under Test (EUT) is an AROMA DIFFUSER with Bluetooth operated at 2.4GHz



# 4 Summary of Test Standards

Test Standards				
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES			
10-1-2018 Edition	Subpart C - Intentional Radiators			
RSS-Gen Issue 5 April 2018	General Requirements for the Certification of Radio Apparatus			
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices			

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance V05 and ANSI C63.10 (2013).



# 5 Summary of Test Results

	Т	echnical Requirements			
FCC Part 15 Sub	part C/RSS-247 Is	sue 2/RSS-Gen Issue 5			
Test Condition			Pages	Test Result	Test Site
§15.207	RSS-GEN 8.8	Conducted emission AC power port	10	Pas	Site 1
§15.247(b)(1)	RSS-247 Clause 5.4(d)	Conducted peak output power	12	Pass	Site 1
§15.247(e)	RSS-247 Clause 5.2(b)	Power spectral density*		N/A	
§15.247(a)(2)	RSS-247 Clause 5.2(a)	6dB bandwidth		N/A	
§15.247(a)(1)	RSS-247 Clause 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	19	Pass	Site 1
§15.247(a)(1)	RSS-247 Clause 5.1(b)	Carrier frequency separation	29	Pass	Site 1
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Number of hopping frequencies	32	Pass	Site 1
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Dwell Time	34	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	39	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Band edge	43	Pass	Site 1
§15.247(d) & §15.209 &	RSS-247 Clause 5.5 & RSS-GEN 6.13	Spurious radiated emissions for transmitter and receiver	48	Pass	Site 1
§15.203	RSS-GEN 6.8	Antenna requirement	See note 2	Pass	

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a Integrated antenna, which gain is 3.7dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.



# 6 General Remarks

#### Remarks

This submittal(s) (test report) is intended for FCC ID: 2AQU4-PZUA028, IC: 24212-PZUA028 complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C, RSS-247 issue 2 and RSS-Gen issue 5 rules.

The Equipment Under Test (EUT) is an AROMA DIFFUSER with Bluetooth operated at 2.4GHz. The TX and RX range is 2402MHz-2480MHz.

Note: The report is for BDR+EDR.

#### SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed
- □ Not Performed

The Equipment Under Test

- - Fulfills the general approval requirements.
- □ **Does not** fulfill the general approval requirements.

Sample Received Date:	September 20, 2018
Testing Start Date:	September 20, 2018
Testing End Date:	October 30, 2018

Reviewed by:

Prepared by:

Tested by:

NOW

Laurent Yuan EMC Project Manager

Dari. In

Dawi Xu EMC Project Engineer

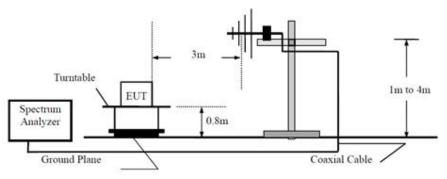
Tree them

Tree Zhan EMC Test Engineer

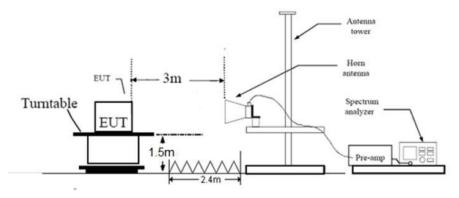


# 7 Test Setups

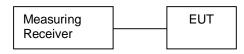
7.1 Radiated test setups Below 1GHz



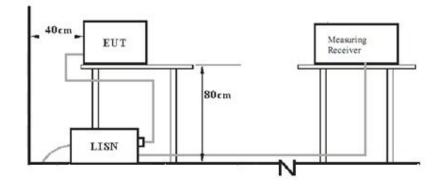
# Above 1GHz



# 7.2 Conducted RF test setups



# 7.3 AC Power Line Conducted Emission test setups





# 8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION MANUFACTURER		MODEL NO.	S/N	

Test software: RF test tool, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

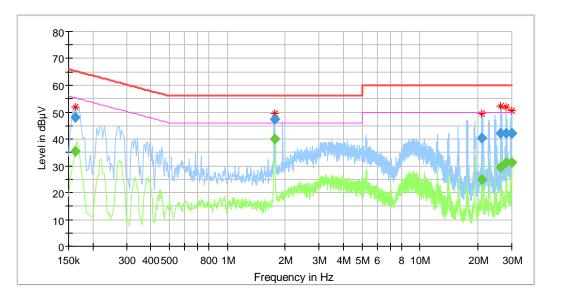


# 9 Technical Requirement

# 9.1 Conducted Emission

M/N:PZ-UA028Mode:Humidify + Lighting + Bluetooth playingTest Spec.:Power Line, LiveComment:AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012



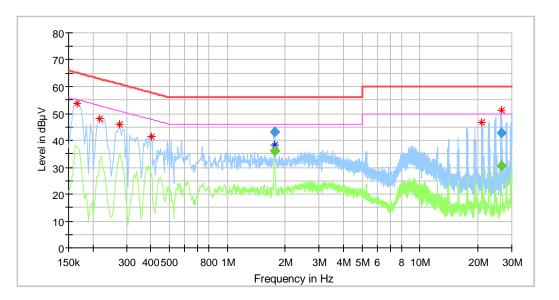
Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.161500		35.32	55.39	20.07	L1	10.2
0.161500	47.94		65.39	17.45	L1	10.2
1.757500		39.89	46.00	6.11	L1	10.3
1.757500	47.52		56.00	8.48	L1	10.3
21.025500		24.95	50.00	25.05	L1	11.0
21.025500	40.38		60.00	19.62	L1	11.0
26.322500		29.57	50.00	20.43	L1	11.0
26.322500	42.10		60.00	17.90	L1	11.0
28.193500		31.31	50.00	18.69	L1	11.1
28.193500	41.99		60.00	18.01	L1	11.1
29.933500		31.33	50.00	18.67	L1	11.1
29.933500	41.95		60.00	18.05	L1	11.1



#### Conducted Emission Test 150kHz – 30MHz

M/N:	PZ-UA028
Mode:	Humidify + Lighting + Bluetooth playing
Test Spec.:	Power Line, Neutral
Comment:	AC 120V/60Hz

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure (mbar) : 1012



ſ	Frequency (MHz)	QuasiPeak (dBuV)	Average (dBuV)	Limit (dBuV)	Margin (dB)	Line	Corr. (dB)
		(ασμν)	( F )	<b>1 1 1</b>	. ,		• •
	1.761500		36.27	46.00	9.73	N	10.3
	1.761500	43.15		56.00	12.85	Ν	10.3
	26.473500		30.40	50.00	19.60	Ν	11.2
	26.473500	42.84		60.00	17.16	Ν	11.2



# 9.2 Conducted peak output power

#### **Test Method**

- Use the following spectrum analyzer settings: Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Add a correction factor to the display.
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

# **FCC** Limits

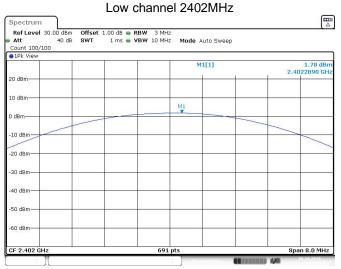
	Frequency Range	Conducted output Limit	Limit
_	MHz	W	dBm
_	2400-2483.5	≤1	≤30
IC Limits			
	Frequency Range	Conducted output Limit	Limit
_	MHz	W	dBm
	2400-2483.5	≤1	≤30
	Frequency Range	E.I.R.P Limit	E.I.R.P Limit
	MHz	W	dBm

	VV	ubili
2400-2483.5	≤4	≤36



## Conducted peak output power

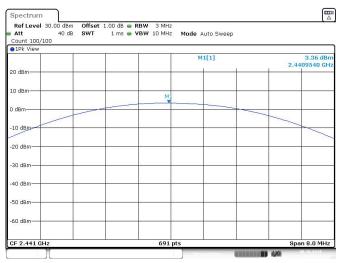
Bluetooth M	ode GFSK modulat	ion Test Result	
	Conducted Peak		
Frequency	Output Power	E.I.R.P	Result
MHz	dBm	dBm	
Low channel 2402MHz	1.7	5.4	Pass
Middle channel 2441MHz	3.3	7.0	Pass
High channel 2480MHz	3.7	7.4	Pass



Date: 8.0CT.2018 18:07:03



#### Middle channel 2441MHz



Date:8.0CT.2018 18:09:21

Ref Level 30.00 dBn Att 40 dB	.00 dB 👄 RB 1 ms 👄 VB		Mode Auto Sweep			
Count 100/100 Pk View						
			M1[1]			3.73 dB 8150 GF
20 dBm	-			+ +	2.4790	5130 Gr
10 dBm		M1				
		NT NT				
0 dBm					~	
-10 dBm		-				~
-20 dBm						
-30 dBm						
-40 dBm						
-50 dBm	-					
-60 dBm						
CF 2.48 GHz		691 p	ts		Snan	8.0 MH:

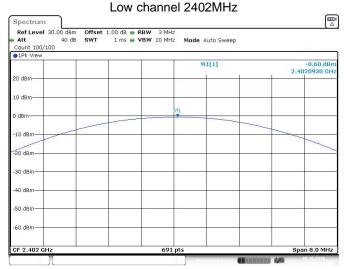
Date:8.0CT.2018 18:12:11

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#### Bluetooth Mode $\pi/4$ -DQPSK modulation Test Result Conducted Peak

Frequency MHz	Output Power dBm	E.I.R.P dBm	Result
Low channel 2402MHz	-0.6	3.1	Pass
Middle channel 2441MHz	1.2	4.9	Pass
High channel 2480MHz	1.7	5.4	Pass



Date: 8.0 CT.2018 18:14:04

#### Report Number: 68.910.18.0077.01



Att Count 100/1	30.00 dBm 40 dB 00	SWT	00 dB 👄 I 1 ms 👄 '	RBW 3 MHz /BW 10 MHz	Mode Auto Swee	p	
●1Pk View					M1[1]		1.23 dBn 2.4407920 GH
20 dBm			đ				
10 dBm							
0 dBm				M1 <b>X</b>			
-10 dBm							
-20 dBm							
-20 UBIII							
-30 dBm							
-40 dBm							
-50 dBm							
-60 dBm							

Middle channel 2441MHz

Date:80CT.2018 18:16:31

Ref Level 30.0 Att Count 100/100	0 dBm Offset 40 dB SWT	1.00 dB 👄 R 1 ms 👄 V	BW 3 MHz BW 10 MHz	Mode Auto Sweep		
●1Pk View						
				M1[1]	5	1.69 dB 2.4798150 G
20 dBm-		1				
10 dBm						
			M1	a		
0 dBm		-		1000	1	
-10 dBm						-
-20 dBm						
-20 dBm						
-30 dBm						
-40 dBm						
-50 dBm						
43.						
-60 dBm						

Date: 8.0 CT.2018 18:18:04

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#### Bluetooth Mode 8DPSK modulation Test Result Conducted Peak

Frequency MHz	Output Power dBm	E.I.R.P dBm	Result
Low channel 2402MHz	-0.3	3.4	Pass
Middle channel 2441MHz	1.5	5.2	Pass
High channel 2480MHz	2.0	5.7	Pass

#### Low channel 2402MHz Spectrum Ref Level 30.00 dBm Offset 1.00 dB RBW 3 MHz Att 40 dB SWT 1 ms VBW 10 MHz Count 100/100 100 100 100 100 100 Mode Auto Sweep ●1Pk View -0.36 dBm 2.4020810 GHz M1[1] 20 dBm-10 dBm-0 dBn -10 dBm--20 dBm--30 dBm--40 dBm--50 dBm--60 dBm-CF 2.402 GHz Span 8.0 MHz 691 pts

Date: 8.0 CT.2018 18:20:00

#### Report Number: 68.910.18.0077.01



	M1[1]	1.56 dBn 2.4409190 GH
M1		
	/T 1 ms • VBW 10 MHz	Ims         VBW         IO MHz         Mode         Auto Sweep           M1[1]

Middle channel 2441MHz

Date: 8.0 CT.2018 18:27:17

	00 dB 👄 RBW 3 MHz 1 ms 👄 VBW 10 MHz	Mode Auto Sweep	
1Pk View		M1[1]	1.99 dB
) dBm			2.4799310 G
) dBm			
dBm-	Ma		
0 dBm			
0 dBm			
0 dBm			
	691	ots	Spö

Date: 8.0 CT.2018 18:29:18



# 9.3 20 dB bandwidth and 99% Occupied Bandwidth

#### **Test Method**

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

### Limit

Limit [kHz]

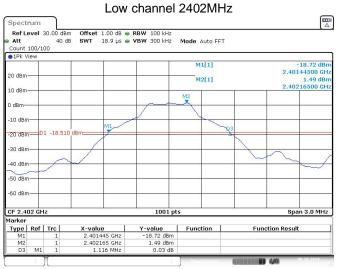
N/A



#### 20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1116	863		Pass
2441	1119	860		Pass
2480	1122	857		Pass



Date: 8.0 CT.2018 18:07:23

●1Pk View							
			M	1[1]			-2.07 dBr 05690 GH
20 dBm				CC BW			63137 kH
				1 1			
10 dBm							
			MI				
) dBm							
10 dBm		N	MAN				
		M	7	~			
-20 dBm		T1 W		VAT2			
	1	J.V.		1			
-30 dBm	- AV		-		1		
2007 10	N				m		
-40 dBm	0 1				500	m	
50 dBm	~ns				VV	h	mand
www	<u> </u>						A. V.
-60 dBm							

Date: 8.0 CT.2018 18:07:34



Middle channel 2441MHz Spectrum Ref Level 30.00 dBm Att 40 dB Count 100/100 Offset 1.00 dB ● RBW 100 kHz SWT 18.9 µs ● VBW 300 kHz Mode Auto FFT 01Pk View -17.29 dBm 2.44043600 GHz 2.96 dBm 2.44116500 GHz M1[1] 20 dBm M2[1] 10 dBm-M 0 dBn -10 dBm-D1 -17.035 dBr -20 dBm--30 dBm 40 dBm--50 dBm -60 dBm CF 2.441 GHz Span 3.0 MHz 1001 pts Marker Type Ref Trc Y-value -17.29 dBm X-value 2.440436 GHz 2.441165 GHz 1.119 MHz Function Function Result M1 M2 D3 2.96 dBm 0.14 dB M1 **A** ( **A** ( **A** ( **A** )) Date:8.0CT.2018 18:09:41 Spectrum 
 Ref Level 30.00 dBm

 Att
 40 dB

 Count 100/100

 IPk View
 00 dBm Offset 1.00 dB 👄 RBW 20 kHz 40 dB SWT 94.8 μs 👄 VBW 100 kHz Mode Auto FFT -0.48 dBm 2.44105690 GHz 860.139860140 kHz M1[1] 20 dBm Occ Bw 10 dBm 0 dBn mmm -10 dBm XC Mr2 -20 dBm -30 dBm-40 dBm m M -gardam 60 dBm Span 3.0 MHz CF 2.441 GH 1001 pts

Date: 8.0 CT.2018 18:09:52

#### Report Number: 68.910.18.0077.01



#### High channel 2480MHz

Ref Level 30.00 df Att 40 Count 100/100		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>	Mode Auto FFT			
1Pk View	5 K.	50 - 50				
			M1[1]			.97 dB
20 dBm			M2[1]		2.47943	600 GF 1.37 dB
			m2[1]		2.48016	
10 dBm-			M2			
0 dBm			~		-	
1987 C. 1000						
-10 dBm	M1		~	03		
-20 dBm D1 -16.63	32 dBm			Q3		
-30 dBm						
-40 dBm	$\sim$			~		
						-
-50 dBm						
-60 dBm						
do dom						
CF 2.48 GHz		1001 pt	ts		Snan (	3.0 MH
Marker		1001 p			opunt	
Type   Ref   Trc	X-value	Y-value	Function	Fun	ction Result	
M1 1	2.479436 GHz					
M2 1	2.480165 GHz	3.37 dBm				
	1.122 MHz		Moasuring		<b>1 4243</b> - 1011	0.2018
ate: 8.0 CT 2018 18:12: Spectrum Ref Level 30.00 di	1.122 MHz	0.05 dB	No astreing		10.1	0.2018 [
ate: 8.0CT 2018 18:12: Spectrum Ref Level 30.00 di Att 40	1.122 MHz	0.05 dB	Mode Auto FFT		) (A)AGA (18:1	0,2018 [ [
ate: 8 OCT 2018 18:12: Spectrum Ref Level 30.00 di Att 40 Count 100/100	1.122 MHz	0.05 dB	Mode Auto FFT		) (A)AA) (16:1	0.2013
ate: 8.0CT 2018 18:12: Spectrum Ref Level 30.00 di Att 40	1.122 MHz	0.05 dB			-00-1	
att 100 mm 1000 mm 1000 mm 100 mm 100 mm 100 mm 100 mm 100 mm 10	1.122 MHz	0.05 dB	M1[1]		2.48005	1.09 dB 1690 GH
att 100 mm 1000 mm 1000 mm 100 mm 100 mm 100 mm 100 mm 100 mm 10	1.122 MHz	0.05 dB				1.09 dB 1690 GH
Att 40 Count 100/100 100 dBm 20 dBm	1.122 MHz	0.05 dB	M1[1]		2.48005	1.09 dB 1690 GH
Att 40 Count 100/100 100 dBm 20 dBm	1.122 MHz	0.05 dB	M1[1]		2.48005	1.09 dB 1690 GH
ate:80CT2018 1812:           Spectrum           Ref Level 30.00 dl           Att           40           Count 100/100           Itk View           20 dBm           10 dBm	1.122 MHz	0.05 dB	M1[1]		2.48005	1.09 dB 1690 GH
ate:80CT2018 1812:           Spectrum           Ref Level 30.00 dl           Att           40           Count 100/100           Itk View           20 dBm           10 dBm	1.122 MHz	0.05 d8     0.05 d8     0.05 d8     0.05 d8     0.05 d8	M1[1]		2.48005	
ame:80CT2018         18121           Spectrum         Ref Level         30.00 dl           Att         40         Count.100/100           Other         Odm         10 dBm           10 dBm         0 dBm         0	1.122 MHz	0.05 d8     0.05 d8     0.05 d8     0.05 d8     0.05 d8	M1[1]		2.48005	1.09 dB 1690 GH
Att::80CT2018 1812:           Spectrum           Ref Level 30.00 dl           Att           40           Count 100/100           IPk View           20 dBm           10 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005	1.09 dB 1690 GH
ate:80CT2018 1812:           Spectrum           Ref Level 30.00 dl           Att           40           Count 100/100           INF View           20 dBm           10 dBm           -10 dBm	1.122 MHz		M1[1]		2.48005	1.09 dB 1690 GH
ate:80CT2018 1812: Spectrum Ref Level 30.00 dl Att 40 Count 100/100 O LPk View 20 dBm 10 dBm 0 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005	1.09 dB
am::80CT2018         1812:           Spectrum	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005	1.09 dB 1690 GH
Atte: 8.0 CT 2018 1812:           Spectrum           Ref Level 30.00 dl           Att           40           Count 100/100           IPk View           20 dBm           10 dBm           -10 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005	1.09 dB 1690 GH
Auto:::80CT2018         1842:           Spectrum         Ref Level         30.00 dl           Att         40         0.00 dl           O dBm         0         0 dBm           10 dBm         -10 dBm         -20 dBm           -30 dBm         -30 dBm         -30 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005 857.142857	1.09 dB 1690 GH
Auto:         80 CT 2018 1812:           Spectrum         40           Count 100/100         10 He View           20 dBm         10 dBm           10 dBm         -20 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005 857.142857	1.09 dB 1690 GH
ate::80CT2018 1812:           Spectrum           RefLevel 30.00 di           Att           40           Count 100/100           • IPk View           20 dBm           10 dBm           -10 dBm           -20 dBm           -30 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005	0.09 dB 16690 GF 7143 kH
Auto:::80CT2018         1842:           Spectrum         Ref Level         30.00 dl           Att         40         0.00 dl           O dBm         0         0 dBm           10 dBm         -10 dBm         -20 dBm           -30 dBm         -30 dBm         -30 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005 857.142857	1.09 dB 1690 GH
ate::80CT2018 1812:           Spectrum           RefLevel 30.00 di           Att           40           Count 100/100           • IPk View           20 dBm           10 dBm           -10 dBm           -20 dBm           -30 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005 857.142857	0.09 dB 16690 GF 7143 kH
ate:80CT2018 1812:           Spectrum           Ref Level 30.00 dl           Att           40           Count 100/100           10/100           110 dBm           0 dBm           -10 dBm           -30 dBm           -40 dBm	1.122 MHz 31 3m Offset 1.00 dB SWT 94.8 µs		M1[1]		2.48005 857.142857	0.09 dB 16690 GF 7143 kH

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# 20 dB bandwidth and 99% Occupied Bandwidth

siueto	cooth Mode 11/4-DQPSK Modulation test result						
	Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result		
_	MHz	kHz	kHz	kHz			
-	2402	1377	1175		Pass		
	2441	1371	1166		Pass		
	2480	1371	1166		Pass		

# Bluetooth Mode π/4-DQPSK Modulation test result

Ref Level 30.00 d Att 40 Count 100/100			Mode Auto FF	τ	
1Pk View	1 1		M1[1]		-22.54 dB
			witti		2.40131300 GH
20 dBm-			M2[1]		-2.25 dB
10 dBm-					2.40200000 GH
10 0011					
0 dBm		M2			
	1	$\sim$	~		
-10 dBm	$\sim$		~		
	MI				
-20 dBm D1 -22.2		-		23	
-30 dBm			-		
-30 UBIII					
-40.dBm				~	~~~~~
-50 dBm		-			
-60 dBm		2 C			
CF 2.402 GHz		1001 pts	5		Span 3.0 MH:
1arker					
Type Ref Trc M1 1	2.401313 GHz	-22,54 dBm	Function	Functi	on Result
M1 1 M2 1	2.401313 GHz 2.402 GHz	-22.54 dBm			
D3 M1 1	1.377 MHz	0.23 dB			
N			1	former 4	00.10.2010

#### Spectrum Operation Offset 1.00 dB RBW 20 kHz Att 40 dB SWT 94.8 µs VBW 100 kHz Mode Auto FFT Count 100/100 FW 100 kHz VBW 100 kHz Mode Auto FFT Optimization 101 kHz VBW 100 kHz VBW 100 kHz Mode Auto FFT -5.01 dBm 2.40200300 GHz 1.174825175 MHz M1[1] 20 dBm DCC BW 10 dBm· 0 dB -10 dBm-Whymy www N -20 dBm--30 dBm 40 dBm w Soden -60 dBm-CF 2.402 GH 1001 pt Span 3.0 MHz 1 440

Date:80CT.2018 18:14:36



Att 40 c Count 100/100		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> <li>M</li> </ul>	Iode Auto FFT			
●1Pk View	1		M1[1]		-5	20.44 dBm
20 dBm		-	M2[1]			30700 GHz -0.38 dBm
10 dBm					2.4410	00000 GHz
0 dBm						
-10 dBm				1		
20 dBm D1 -20.37	75 dBm			¥03		
-30 dBm				1		
-48 dBm						
-50 dBm						
-60 dBm		_				
CF 2.441 GHz		1001				1 3.0 MHz
CF 2.441 GHz Marker		1001 pts			Spar	13.0 MHZ
Type         Ref         Trc           M1         1           M2         1	X-value 2.440307 GHz 2.441 GHz	Y-value -20.44 dBm -0.38 dBm	Function	Fund	tion Result	
D3 M1 1	1.371 MHz	-0.11 dB				
Spectrum			Afoasuring			10.2018
ate:80CT 2018 18:16: Spectrum Ref Level 30.00 dB Att 40 0	3m Offset 1.00 dB	<ul> <li>RBW 20 kHz</li> <li>VBW 100 kHz</li> </ul>	lode Auto FFT			E10.2018
Spectrum Ref Level 30.00 dB Att 40 d Count 100/100	3m Offset 1.00 dB		No Auto FFT			E 10.2018
Spectrum Ref Level 30.00 dB Att 40 d	3m Offset 1.00 dB					
Spectrum Ref Level 30.00 dB Att 40 o Count 100/100 1Pk View	3m Offset 1.00 dB		Model Auto FFT M1[1] Occ Bw		2.4410	-3.14 dBm 00000 GHz 14166 MHz
Spectrum  Ref Level 30.00 db  Att Count 100/100  Pk View  20 dBm	3m Offset 1.00 dB		M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum         Ref Level 30.00 db           Att         40 d           Count 100/100         10k View           20 dbm         10 dbm	3m Offset 1.00 dB		M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum         Ref Level 30.00 dB           • Att         40 c           Count 100/100         0           • IPk View         20 dBm           10 dBm         0	3m Offset 1.00 dB		M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum         Ref Level 30.00 db           Att         40 d           Count 100/100         10k View           20 dbm         10 dbm	Sm Offset 1.00 dB SWT 94.8 µs	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum         Ref Level 30.00 dB           • Att         40 c           Count 100/100         0           • IPk View         20 dBm           10 dBm         0	3m Offset 1.00 dB	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum           Ref Level 30.00 dB           Att         40 c           Count 100/100           IPk View           20 dBm           10 dBm           0 dBm	Sm Offset 1.00 dB SWT 94.8 µs	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 00000 GHz
Ref Level 30.00 dB           Att 40 (           Outr 100/100           • IPk View           20 dBm           10 dBm           -10 dBm           -20 dBm	Sm Offset 1.00 dB SWT 94.8 µs	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum         Ref Level 30.00 dB           • Att         40 of Count 100/100           • DPk View         • De View           • De dBm         • De dBm           • 10 dBm         • - 20 dBm           • - 30 dBm         • - 40 dBm	Sm Offset 1.00 dB SWT 94.8 µs	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 00000 GHz
Spectrum         Ref Level 30.00 db           Att 100/100         0 (count 100/100           Ink View         0 (dbm           20 dbm         0 (dbm           10 dbm	Sm Offset 1.00 dB SWT 94.8 µs	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 10000 GHz 14166 MHz
Spectrum         Ref Level 30.00 dB           • Att         40 of Count 100/100           • DPk View         • De View           • De dBm         • De dBm           • 10 dBm         • - 20 dBm           • - 30 dBm         • - 40 dBm	Sm Offset 1.00 dB SWT 94.8 µs	• VBW 100 kHz M	M1[1]		2.4410	-3.14 dBm 10000 GHz 14166 MHz

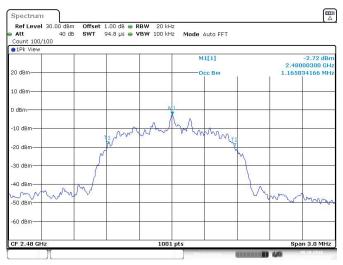
Middle channel 2441MHz

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Refle	evel	30.00 dBr	m Offset 1.00 dB	RBW 100 kHz			4
Att		40 d		• VBW 300 kHz	Mode Auto FFT		
Count	100/1	00					
●1Pk V	iew		10. W	10 A.			
					M1[1]		-20.09 dBr
20 dBm·							2.47930700 GH
20 0011					M2[1]		0.06 dBr
10 dBm·							2.48000300 GH
				M2			
0 dBm—	_						· · · · · · · · · · · · · · · · · · ·
			~	~~~	in here		
-10 dBm	-						
			M1			D3	
-20 dBm	D	1 -19.938	3 dBm			A	
-30 dBm							
40 dBm	-	~~				~	
-40 060							
-50 dBm							
00 000							
-60 dBm	-						
CF 2.4	3 GHz	2		1001 p	ts	_	Span 3.0 MHz
1arker							
Type	Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1		1	2.479307 GHz	-20.09 dBm			
M2		1	2.480003 GHz	0.06 dBm			
D3	M1	1	1.371 MHz	0.07 dB			

Date:8.0CT.2018 18:18:24



Date: 8.0 CT.2018 18:18:35

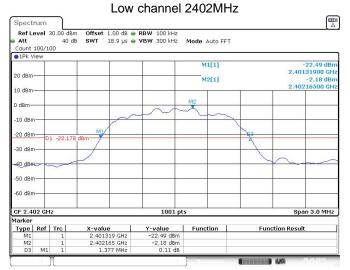
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#### 20 dB bandwidth and 99% Occupied Bandwidth

#### Bluetooth Mode 8DPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
 MHz	kHz	kHz	kHz	
 2402	1377	1160		Pass
2441	1374	1160		Pass
2480	1374	1163		Pass



Date: 8.0 CT.2018 18:20:20

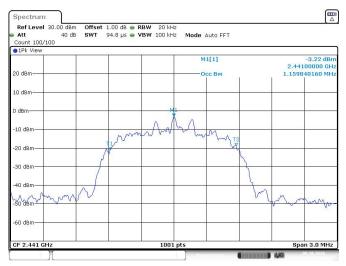
Count 100/100	HO dB <b>SWT</b> 94.1	3 µs 👄 <b>VBW</b> 100 k	Hz Mode Auto	FFT		
1Pk View 20 dBm			M1[1]	N		-5.10 dBr 200000 GH 140160 MH
10 dBm						
0 dBm			MI			
-10 dBm		mm	Andana			
-20 dBm	N			M		
-30 dBm				1		
-40 dBm	m			J~~	how	han
-60 dBm						
CF 2.402 GHz			11 pts			in 3.0 MH

Date: 8.0 CT.2018 18:20:32



	evel	30.00 dBr					(-
Att Count	100/1	40 d	B SWT 18.9 µs 🖷	VBW 300 kHz	Mode Auto FFT		
01Pk V			24 W	10 N.			
					M1[1]		-20.49 dBr
20 dBm							2.44031300 GH
20 0011					M2[1]		-0.35 dBr
10 dBm						1	2.44083500 GH
				M2			
) dBm—	-		-	1.	~		
			~		4m		
-10 dBm	۱ <u> </u>			-		1	
			MI			R3	
20 dBm	D	1 -20.347	7 dBm			Ą	
-30 dBm							
-30 UBI							
40 dBir		~	-			1	
TO GOI	·						
-50 dBm	-				-		
	°   -						
-60 dBm	-			-			
CF 2.4	41 GH	z	1	1001 pt	s	-1	Span 3.0 MHz
larker		-		1001 01			
Type	Ref	Trc	X-value	Y-value	Function	Eun	ction Result
M1		1	2.440313 GHz	-20.49 dBm			
M2		1	2.440835 GHz	-0.35 dBm			
D3	M1	1	1.374 MHz	-0.06 dB			

Date: 8.0 CT.2018 18:27:38



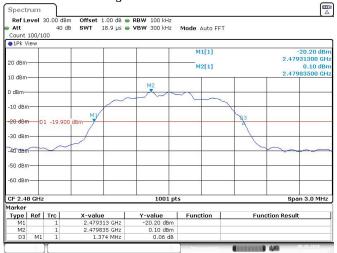
Date: 8.0 CT.2018 18:27:49

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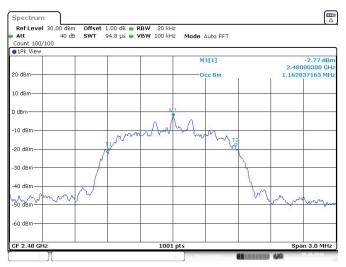
#### Report Number: 68.910.18.0077.01



#### High channel 2480MHz



Date:8.0CT.2018 18:29:38



Date: 8.0 CT.2018 18:29:50

# SUD

# 9.4 Carrier Frequency Separation

# **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. By using the Max-Hold function record the separation of two adjacent channels.
- 3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
- 4. Repeat above procedures until all frequencies measured were complete.

# Limit

Limit kHz

 $\geq$  25KHz or 2/3 of the 20 dB bandwidth which is greater

# GFSK Modulation Limit

Frequency	2/3 of 20 dB Bandwidth
MHz	kHz
2402	744
2441	746
2480	748



# **Carrier Frequency Separation**

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

#### GFSK Modulation test result

Frequency MHz	Carrier Frequency Separation kHz	Result
2402	994	Pass
2441	1006	Pass
2480	1006	Pass

Att 40 dB SWT 18.9 μs	<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> <li>Mode Auto FFT</li> </ul>	
Count 100/100 Plk View	15 54	
20 dBm	M1[1] D2[1]	2.48 dB 2.44100725 G 0.15 ( 994.20 k)
10 dBmM1		
0 dBm		D2
-10 dBm		
-20 dBm		
-30 dBm-		
-40 dBm-		
-50 dBm		
-60 dBm-		
Start 2.4405 GHz	691 pts	Stop 2.4425 GH

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	Mode Auto FFT	t 1.00 dB 👄 RBW 100 kHz 18.9 μs 👄 VBW 300 kHz	40 dB SWT	Ref Level 3 Att Count 100/10
				1Pk View
-0.71 dBm 2.44100145 GHz 0.07 dB 1.00580 MHz	M1[1] D2[1]			20 dBm
				10 dBm
D2			MI	0 dBm
				-10 dBm
				-20 dBm
				-30 dBm
				-40 dBm
				-50 dBm
				-60 dBm
	s	691 pt:	405 GHz	Start 2.4405

Middle channel 2441MHz

Date:10.0CT.2018 10:15:15

Count 100/100	40 dB <b>SWT</b> 18.9 μ	s 👄 <b>VBW</b> 300 kH:	z Mode Auto FFT	
1Pk View				
20 dBm			M1[1]	-0.78 dB 4099855 GF 0.11 c 1.00580 MF
10 dBm				 
0 dBm	MI			
-20 dBm				
-30 dBm				 -
-40 dBm				 
-50 dBm				 _
-60 dBm				

Date: 10.0 CT.2018 10:25:27



# 9.5 Number of hopping frequencies

#### **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
- 3. Record all the signals from each channel until each one has been recorded.
- 4. Repeat above procedures until all frequencies measured were complete.

#### Limit

Limit number ≥ 15



#### Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.

Number of hopping frequencies	Result		
79	Pass		
	c.		
pectrum Ref Level 30.00 dBm Offset 1.00 dB 🖷 RBW 100 kHz	['		
Att 40 dB SWT 1 ms 🖷 VBW 300 kHz Mode Auto Sweep			
1Pk View	1 1 1		
dBm-			
dBm			
anan an			
₽₿₩₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽₽			
) dem	HIRWARD AND A MANAGE		
) dBm			
0 dBm			
D dBm			
D dBm			
J doin			
D dBm			
art 2.4 GHz 691 pts	Stop 2.4835 GH		

Date: 8.0 CT.2018 18:33:01



# 9.6 Dwell Time

## **Test Method**

- 1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
- 2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
- 3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
- 4. Measure the Dwell Time by spectrum analyzer Marker function.
- 5. Repeat above procedures until all frequencies measured were complete.

### Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



#### **Dwell Time**

#### Dwell time

The maximum dwell time shall be 0.4 s.

According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

The Dwell Time = Burst Width \* Total Hops. The detailed calculations are showed as follows: The duration for dwell time calculation: 0.4 [s] \* hopping number = 0.4 [s] \* 79 [ch] = 31.6 [s\*ch];

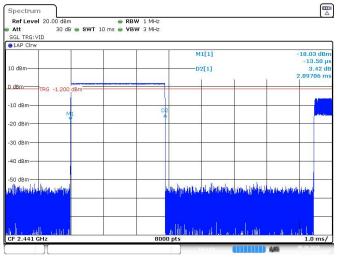
The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5=1600 / 6 / 79 \*31.6=106.67

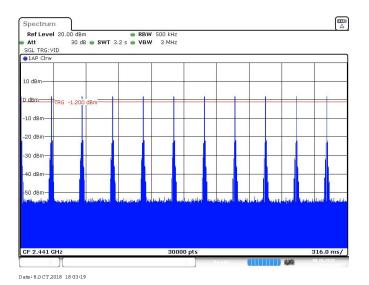
Modulation	Mode	Reading (us)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	DH5	2971	106.67	319	< 400	Pass
π/4-DQPSK	2DH5	2971	106.67	319	< 400	Pass
8-DPSK	3DH5	3000	106.67	320	< 400	Pass

#### Test Result

# **GFSK Modulation**

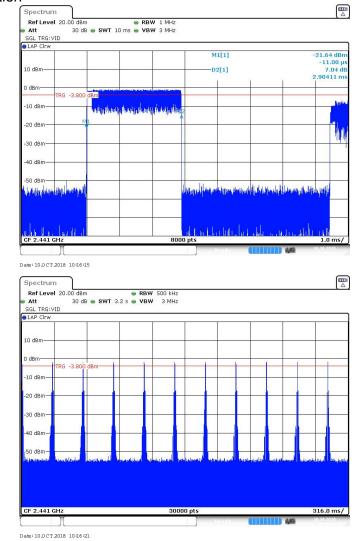


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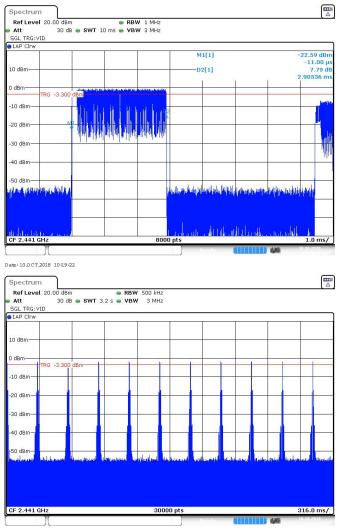


#### π/4-DQPSK Modulation



2DH5

## 8-DPSK Modulation



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3DH5



# 9.7 Spurious RF conducted emissions

## **Test Method**

- Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 3. The level displayed must comply with the limit specified in this Section. Submit these plots.
- 4. Repeat above procedures until all frequencies measured were complete.

#### Limit

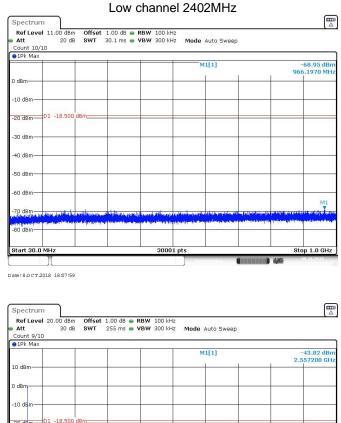
Frequency Range MHz	Limit (dBc)
30-25000	-20



#### **Spurious RF conducted emissions**

Only the worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

BT3.0 GFSK Modulation:



-70 dBm							
60,6	ale Helesters	ing page and a solid strange data and a solid strange of the	ala din katalan Marina din katalan	Malaban Instantions Instanting Instantions	annallaingar annallaingar	agaanihalima aya waxininininininini	edi el constant Productioned
-50 dEm							
-40 d§m							
-30 d6m							

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40

70 dBm

tart 1.0 G

Date:8.0CT.2018 18:10:19



Count 10			1.00 dB 👄 30.1 ms 👄			Auto Sweep	0		
●1Pk Ma>	-		1		0.0	1[1]			-69.01 (
						1[1]			4.0080
0 dBm	-	-							-
-10 dBm—	-		-		-			-	
00.10	D1 -17.080	dBm	-					-	
-20 dBm—									
-30 dBm-									
- So upill									
-40 dBm—	-				-				-
							1		
-50 dBm-	+								
-60 dBm-					2				
								M1	
-/U dBm	الاستعار المتارا المر	unbligan all fi							A white the second
-80 dBm-	Production of the second	and the second	Arranting and Rings	a significant an organ	distantive projects	ef. is provide a set for	a second processing	a Rotorea Artice Sea	al in air fea
00 0011									
Start 30.	0 MHz			3000	1 pts			St	op 1.0 G
	T.					suring	<b>MANAGAN</b>		08,10,2018
Spectru	And a state of the second seco								
		Offset	1.00 dB 👄 🛛	DDW 100 LL					
Att Count 9/		SWT	255 ms 👄 '	VBW 300 kH		Auto Sweep	1		
🖶 Att	30 dB 10	SWT	255 ms 👄 '		iz Mode .		U	8	-43.00 (
Att Count 9/ 91Pk Max	30 dB 10	SWT	255 ms 🖷 '		iz Mode .	Auto Sweep			-43.09 ( 596300
Att Count 9/	30 dB 10	SWT	255 ms 🖷 '		iz Mode .		, 		

30001 pt

Middle channel 2441MHz

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E 44

Stop 26.5 GHz

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#### High channel 2480MHz

				M1	1]	 -69.22 dBn 591.6310 MH
) dBm						 
-10 dBm—						 
-20 dBm—	D1 -16.600	dBm	-			
30 dBm—						 
40 dBm—						
50 dBm—				· · · · ·		 
-60 dBm—					(Sa)	
70 40-					MI	 

Date:8.0CT.2018 18:13:07

					M	1[1]		-42.55 dBm 2.635400 GHz		
10 dBm								2.0	533400 GH	
) dBm										
10 dBm										
20 dBm	D1 -16.600	dBm								
30 dBm										
40 dBm					-					
50 d8m		Gradenson		25102104	. eth adde	l had a start a st	Instal allow to	La to sil	0.0301000	
	and the second second	لروماليك ولللمالي	A A A A B IS A B A A A	the stephen in the	the second second second	What plants	distants, fishakan	and a second	PART OF MARK	

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## 9.8 Band edge testing

#### **Test Method**

- 1 Use the following spectrum analyzer settings:
  - Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

#### Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

## GFSK mode: Hopping off

Att Count 3	300/3	20.00 dBi 30 d 00		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>	Mode Auto FFT		
1Pk Vi	ew				M1[1]		1.31 dBm
0 dBm-	-				M2[1]		2.402040 GHz -51.04 dBm
dBm—					MZ[1]		2.400000 CHz
ubin-						1 1	1
10 dBm	+		2			-	
ZU dBm		1 -18.69	0 dBm				
20 asm	_	1 -10.03					
30 dBm	+						_
							1 10
40 dBm	+						
50 dBm	_			_			Me
						мз	, N
iQ dBm	anne	mounder	mounderstonet	Mountain Auraly	moundument	the marky murchat	monorod
70 dBm	· · ·			124		o soletilise e articulta	22.0200
tart 2.	3 GH	z		691 pts		St	op 2.405 GHz
arker							
Type	Ref	Trc	X-value	Y-value	Function	Function Re:	sult
M1		1	2.40204 GHz	1.31 dBm			
M2		1	2.4 GHz	-51.04 dBm			
MЗ		1	2.39 GHz	-61.47 dBm			

Date:8.0CT.2018 18:07:44

Ref Lo Att Count		20.00 dBr 30 d 20			Mode Auto Sv	weep	
●1Pk V 10 dBm		м1 Х			M1[1]		3.34 dB 2.480130 G -58.33 dB 2.483500 G
0 dBm-		1				1 1	2.483300 G
-10 dBm	n	1 -16.660	) dBm				
-30 dBn -40 dBn	11						
-50 dBr	$\mathbb{A}$	UND4	M			Å	
-70 dBn			A walk and a second	and the second		a juning and delay by Mar	markey and the second
Start 2		Hz		691 pts			Stop 2.55 GH
Marker							
Type	Ref	Trc	X-value	Y-value	Function	Func	tion Result
M1		1	2.48013 GHz	3.34 dBm			
M2		1	2.4835 GHz	-58.33 dBm			
M3 M4		1	2.5 GHz 2.484029 GHz	-60.26 dBm -57.43 dBm			

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EMC\_SZ\_FR\_21.00FCC Release 2014-03-20

## GFSK mode: Hopping on

Ref Level Att Count 300/	30 0		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>	Mode Auto FF	т		
<ul> <li>1Pk View</li> </ul>	500	5. X5	16 - 16 -				
				M1[1]			1.81 dBn
LO dBm				110141			04920 GH:
				M2[1]			58.05 dBn 00000 GH;
) dBm			· ·	- 1	1	2.4	
10 dBm-							W
							0.
20 dBm-	D1 -18.19	U dBm					
30 dBm							
40 dBm		M4					
50 deiro			-				
1MI MIM	MARIAN	Musuaaaaa	In driving of	e challent i			M2
éti ge Mi <del>lli</del>	Nollollal	Munimprum	HUMUM MAN	LAMUM MA	Mannas	and the for the	well
70 dBm-				1			2010
/ U UBIII							
Start 2.3 G	Hz		691 pts	10		Stop 2	2.405 GHz
larker							
Type   Ref	Trc	X-value	Y-value	Function	Fund	ction Result	
M1	1	2.40492 GHz	1.81 dBm				
M2	1	2.4 GHz	-58.05 dBm				
M3 M4	1	2.39 GHz 2.322978 GHz	-62.99 dBm -47.86 dBm				

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	evel 20.00		set 1.00 dB 👄							
Att	300/300	30 dB <b>SW</b>	T 1.1 ms 👄	VBW 300 kH	z Mode	Auto S\	veep			
01Pk V										
		1			M	1[1]				3.14 dBr
10 dBm·									2.4	80010 GH
TO ODIII	M1				M	2[1]				60.13 dB
A BBB D	AAAAA								2.4	83500 GH
AMAU	HUAL									
, iq deh	11/11/1						-			
	D1 -16	.860 dBm-					_			
-20 dBm						1	-			
-30 dBm										
-30 UBII	- And									
-40 dBm					-	-	_			
-50 dBm	+		M4 M3	3			4 5 4 1		ann bà bà bà b	1884600
		12	In Indial		ANAAAAAA	111101	BOM	UNNAAAA	NIMANN	NUMMU.
-60 dBm	-	marrier	Man Marine	where we have a start of the st	MARCHAR!	100000	μινυ	40080080	****	4
-70 dBm										
-70 ubii										
Start 2	.47 GHz		17	691	nts		-		Stor	2.55 GHz
Marker										
	Ref   Trc	X-1	/alue	Y-value	Func	tion	1	Func	tion Result	
M1	1		.48001 GHz	3.14 dE						
M2			2.4835 GHz	-60.13 dB	Im					
МЗ	1		2.5 GHz	-56.78 dB	Im					
M4		2.	497014 GHz	-56.94 dB	m					

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## 8DPSK mode: Hopping off

Att Count		20.00 dBr 30 d		<ul> <li>RBW 100 kHz</li> <li>VBW 300 kHz</li> </ul>	Mode Auto FFT		
●1Pk V							-
					M1[1]		-2.18 dBn 2.402040 GH
10 dBm					M2[1]		-53.68 dBn
) dBm-					matri		2.400000 KH
J UBIII-						1 1	
10 dBm	-						A
20 dBr		1 -22.180	0 dBm				
30 dBm							
SU UBII							
40 dBm	1						
							Nato
50 dBm	1						
60 dBm				and the second second			M3
white	inher	investigations	when the man	a manuna and	mentaliman	mannanth	multingen
70 dBm							
Start 2	.3 GH	z	10 BY	691 pts		24 V.	Stop 2.405 GHz
larker							
Type	Ref	Trc	X-value	Y-value	Function	Functio	n Result
M1		1	2.40204 GHz	-2.18 dBm			
M2		1	2.4 GHz 2.39 GHz	-53.68 dBm -61.87 dBm			
M3							

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Att Count		20.00 dBn 30 df 30			Mode Auto Sw	veep	
●1Pk V					M1[1]		0.04 dB
10 dBm	N	41			M2[1]		2.480010 G -58.82 dB 2.483500 G
0 dBm—		λ.		-		1	2.483500 G
-10 dBm	-	<u>  </u>		_			
-20 dBm	D	1 -19.960	dBm				
-30 dBm							
-40 dBm		1					
-50 dBm	T.						
-60,dBra	4	M2	Marana Ma	Contraction and the second	to manager all deserve	www.	mulater
-70 dBm	-						
Start 2	.47 G	Hz		691 pt	s		Stop 2.55 GH
Marker							
Type	Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1		1	2.48001 GHz	0.04 dBm			
M2		1	2.4835 GHz	-58.82 dBm			
M3		1	2.5 GHz	-58.22 dBm			

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## 8DPSK mode: Hopping on

Att Count	300/3	20.00 dBr 30 d 00		B 👄 RBW 100 Is 👄 VBW 300		Mode	Auto FFT			
∎1Pk Vi	ew		T T	-	-	MI	[1]			-5.63 dBm
10 dBm·							1.1			04920 GHz
TO OPIN-						MS	2[1]			59.13 dBm
) dBm—					_			a	2.4	00000 GH
								1	1	1.1
10 dBm	+		-		-			-		- AP
20 dBm										
-20 aBm		1 -25.630								
30 dBm		1 -20.030	a a a a a a a a a a a a a a a a a a a							
	8									1321
40 dBm	+					-				
ro do -										1
50 dBm		1000	7933							M2
80 334	ыW	WAR AN	White the state	1. Autorita data					M3	
		. 10 v .	. manney marke	winderstation	ALCOND.	Vilany	hornwall	allowan	mangathered	when?"
70 dBm	+				-			-		
Start 2	.3 GH	lz	19 BY	69	)1 pts	16		- 24	Stop 2	2.405 GHz
larker										
Туре	Ref	Trc	X-value	Y-value		Funct	ion	Fund	ction Result	
M1		1	2.40492 GHz							
M2	_	1	2.4 GHz							
M3		1	2.39 GHz 2.301065 GHz							

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Ref Lo Att Count		0.00 dBn 30 dB		<ul> <li>RBW 100 kH;</li> <li>VBW 300 kH;</li> </ul>		Auto Swe	ер		
Ount 1Pk Vi		10							
					M	1[1]			-0.55 dB
10 dBm									72030 GI
M1					M	2[1]			60.43 dE
0 uBm-	and the	in the second				1	1	2.4	183300 G
-10 dBm		4							
-10 asu			5						
-20 dBm		-20.550	dBm						
		20.000	dom						
-30 dBm		-			р. — — — — — — — — — — — — — — — — — — —				
		4							
-40 dBm	1	4							
-50 dBm		1					_		
00 000		M2	N N	13		0.124	mount	Andahah	market
-60 dBm	∩—	100	aturner and and a star	En marine	wannew	unun	mannen	an hand	AN NO VU
-70 dBm	1						-		
Start 2	.47 Gł	lz		691	pts		10	Stop	2.55 GH
Marker									
Type	Ref	Trc	X-value	Y-value	Func	tion	Fun	ction Result	1
M1		1	2.47203 GHz	-0.55 dB					
M2		1	2.4835 GHz 2.5 GHz	-60.43 dB -60.34 dB					
M3									

Date:10.0CT.2018 10:16:53



# 9.9 Spurious radiated emissions for transmitter

#### **Test Method**

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

#### For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW ≥ RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

## For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz, VBW  $\ge$  RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

#### Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.



## Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



#### Spurious radiated emissions for transmitter

The only worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

#### Transmitting spurious emission test result as below:

#### BT3.0 GFSK Modulation 2402MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
Dallu	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-	62.926	36.87	Н	40	QP	3.13	-28.17	Pass
1000MHz	63.300	36.87	V	40	QP	3.13	-28.90	Pass
			Н	74	PK			Pass
1000-	2558. 029	48.91	Н	54	AV	5.09	-5.5	Pass
25000MHz			V	74	PK			Pass
			V	54	AV			Pass

#### BT3.0 GFSK Modulation 2441MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
Dallu	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-			Н	43.5	QP			Pass
1000MHz			Н	46	QP			Pass
			Н	74	PK			Pass
1000-			Н	54	AV			Pass
25000MHz			V	74	PK			Pass
			V	54	AV			Pass

#### BT3.0 GFSK Modulation 2480MHz Test Result

Frequency Band	Frequency	Emission Level	Polarization	Limit	Detector	Margin	Correct factor	Result
Dallu	MHz	dBuV/m		dBµV/m		dBuV/m	(dB)	
30-			Н	43.5	QP			Pass
1000MHz			Н	46	QP			Pass
			Н	74	PK			Pass
1000-			Н	54	AV			Pass
25000MHz			V	74	PK			Pass
			V	54	AV			Pass

Remark:

- (1) "\*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 10dB below the permissible limits or the field strength is too small to be measured.
- (3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss



# 10 Test Equipment List

## List of Test Instruments

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2019-7-6
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2019-6-28
Horn Antenna	Rohde & Schwarz	HF907	102294	2019-6-28
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2019-7-6
Signal Generator	Rohde & Schwarz	SMY01	839369/005	2019-7-6
Attenuator	Agilent	8491A	MY39264334	2019-7-6
3m Semi-anechoic chamber	TDK	9X6X6		2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

## **Conducted Emission Test**

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2019-7-6
LISN	Rohde & Schwarz	ENV4200	100249	2019-7-6
LISN	Rohde & Schwarz	ENV432	101318	2019-7-6
LISN	Rohde & Schwarz	ENV216	100326	2019-7-6
ISN	Rohde & Schwarz	ENY81	100177	2019-7-6
ISN	Rohde & Schwarz	ENY81-CA6	101664	2019-7-6
High Voltage Probe	Rohde & Schwarz	TK9420(VT94 20)	9420-584	2019-6-30
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2019-6-30
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2019-7-6
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

#### **TS8997 Test System**

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100A	108272	2019-7-6
Vector Signal Generator	Rohde & Schwarz	SMBV100A	262825	2019-7-6
Communication Synthetical Test Instrument	Rohde & Schwarz	CMW 270	101251	2019-5-31
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2019-7-6
Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2019-7-6
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2019-7-6
Power Splitter	Weinschel	1580	SC319	2019-7-5
10dB Attenuator	Weinschel	56-10	58764	2019-7-6
10dB Attenuator	R&S	DNF	DNF-001	2019-7-6
10dB Attenuator	R&S	DNF	DNF-002	2019-7-6
10dB Attenuator	R&S	DNF	DNF-003	2019-7-6
10dB Attenuator	R&S	DNF	DNF-004	2019-7-6
Test software	Rohde & Schwarz	EMC32	Version 10.38.00	N/A
Test software	Tonscend	System for BT/WIFI	Version 2.6	N/A



# **11 System Measurement Uncertainty**

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncerta	inty
Test Items	Extended Uncertainty
Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.98dB; Vertical: 5.06dB;
Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.95dB; Vertical: 4.94dB;
Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.14dB; Vertical: 5.12dB;
Conducted RF test with TS 8997	Power level test involved: 1.05dB